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FINAL SCIENTIFIC REPORT

Mohamed Abdel-Ham

Air Force Contract ~~F49620-79-C-0093~~

Probabilistic Models & Statistical Inference in Realiability & Replacement Policies

1980

I. RESEARCH ACCOMPLISHED UNDER THE CONTRACT.

i) Optimal Inspection Policy for a Deteriorating Device.

Assume that a device is subject to deterioration. Let $\{x(t), t \geq 0\}$ be the stochastic process describing the deterioration. We assume that it is a Wiener process. Assuming that the deterioration level at a given point in time equals x, then the probability that the device is still alive at the given point in time is $\overline{G}(x)$, where $\overline{G}$ is nonincreasing right continuous. As long as the device is alive it produces an income. Assuming that the amount of deterioration at a given point in time equals y, then the income is $f(y)$, where f is decreasing. Let maintenance, which returns the process to the origin, take m units of time and costs k dollars per unit time. A cycle is defined to be the time between two consecutive maintenances. In this paper we develop the optimal maintenance policy that maximizes the expected income per cycle.

ii) Some Multivariate Life Distributions.

In this paper we define classes of multivariate life distributions (Multivariate Increasing Failure Rate Distributions, etc.) Although definitions of these distributions already exist in the literature, most of them are based on probabilistic arguments and seems not to have much physical meaning. Our approach in defining these life distributions differs significantly from the ones above in the sense that it relies very heavily on the concept of the hazard gradient which is the natural extension

of the concept of the hazard function in the univariate case.
All the properties of life distributions in the univariate case
(such as closeness under mixtures, convolutions, etc.) hold for
our multivariate version of these life distributions. These
multivariate life distributions arise naturally as good models
for life distributions of devices subject to wear and
deterioration.

II. OTHER PROFESSIONAL ACTIVITIES CONDUCTED BY THE PRINCIPAL
     INVESTIGATOR UNDER THE PRESENT CONTRACT.

   i) Participation through lectures and discussions in the
reliability workshop held at Northwestern University during
July 1979.

   ii) Participated in the 9th Conference on Stochastic
Processes and Applications held at Northwestern University,
August 8-12, 1979.

   iii) Organized a workshop on reliability at my home institution
with Professors E. El-Neweihi and J. Quinn participating.

   iv) Gave an invited talk at the 171st Institute of Mathematical
Statistics on Shock Models and Wear Processes.

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